19.5/20

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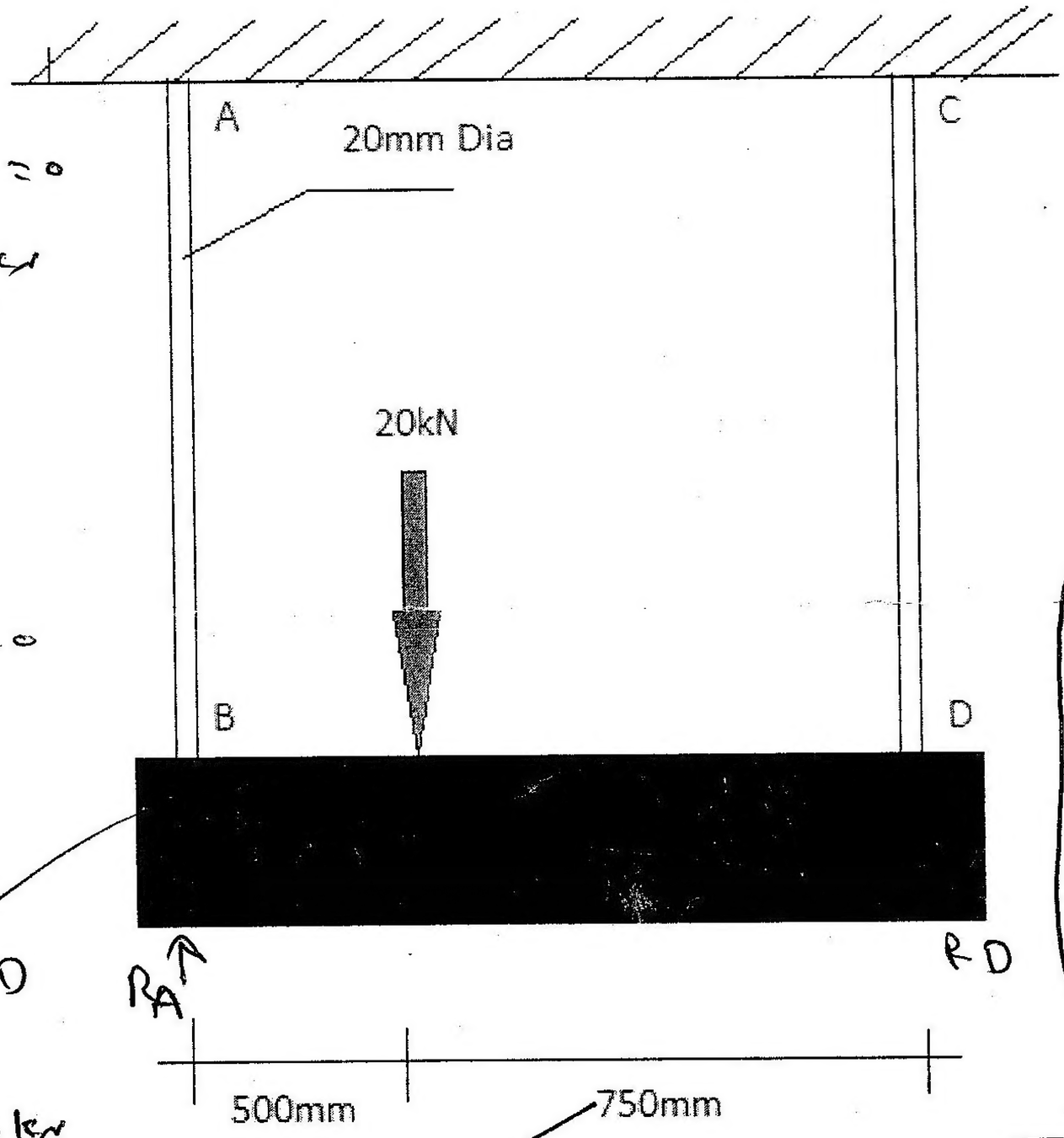
Question One: For the figure shown Determine:

1. The tensile force in cables AB and CD?
2. The Tensile normal stress in cable AB?
3. If the allowable tensile normal Stress in cable CD is 30MPa, determine its required diameter?



(1) $\Sigma F_y = 0$

$T_{AB} - 20kN + T_{CD} = 0$

$T_{AB} + T_{CD} = 20kN$

$M_{RA} = 0$

$-20 * 500 + 1250 R_D = 0$

$\Rightarrow 10000 = 1250 R_D$

$\Rightarrow R_D = \frac{10000}{1250}$

$\Rightarrow R_D = 8kN = T_{CD}$

$T_{AB} + T_{CD} = 20kN$

$T_{AB} + 8kN = 20kN \Rightarrow T_{AB} = 12kN$

(2) $\sigma_{AB} = \frac{P}{A} = \frac{12 * 10^3 kN}{\frac{\pi}{4}(20)^2} = \frac{12000}{314.16} = 3.82 MPa/mm^2$

$\times 1.5$

Allowable

$30 MPa = \frac{8 kN}{A}$

$A = 0.2666$

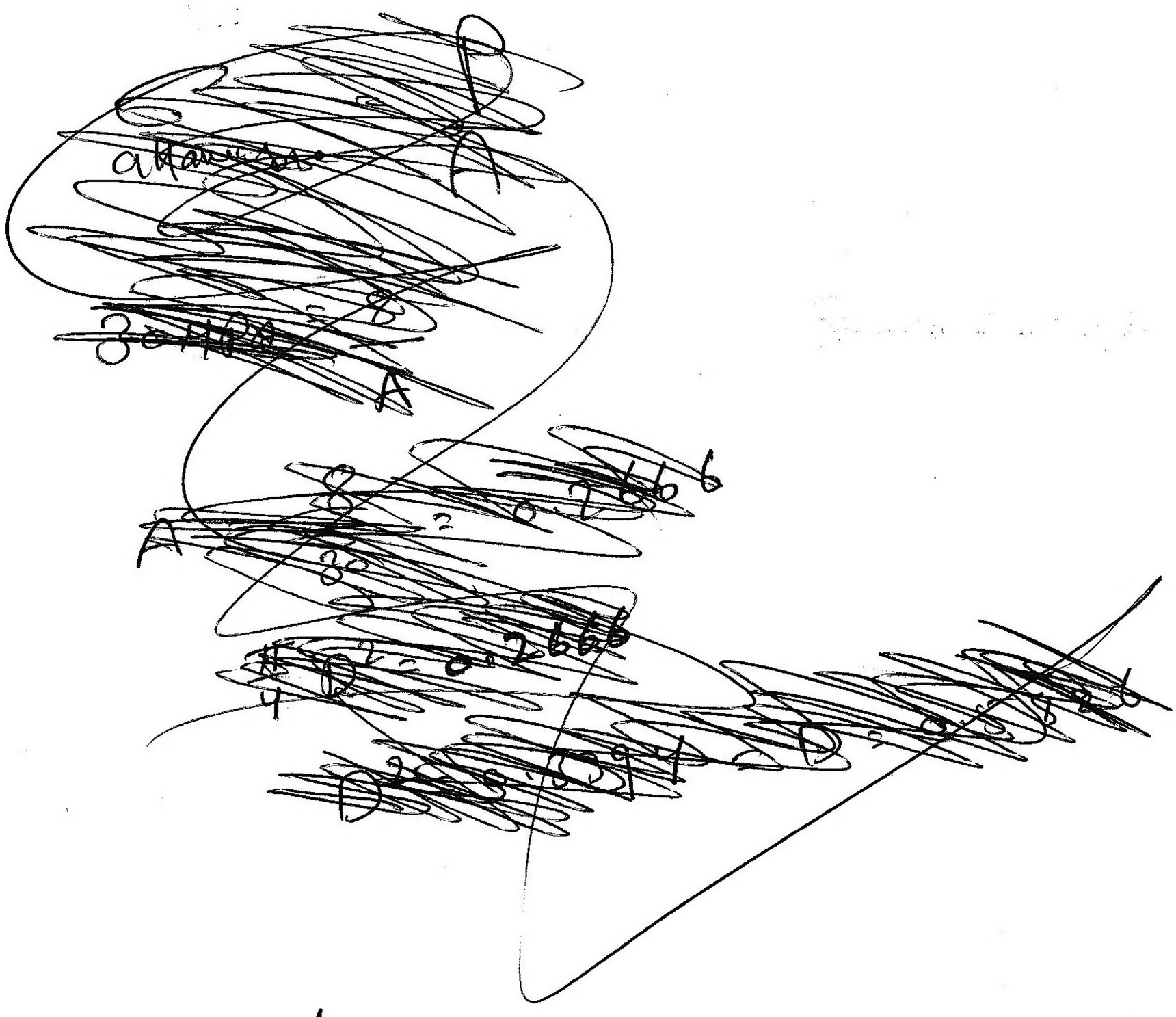
$\frac{\pi}{4} D^2 = 0.2666$

$D^2 = 0.3394$

$D = 58 mm$

قوة مواد
امتحان اول
تم الرفع بواسطة
م. معن ابو عيسى

خلف الورقة



(3) الفقرة الثالثة

$$30MPa = \frac{8\,kN}{A}$$

(1.5) $$30MPa = \frac{8*10^3}{A}$$

$$30MPa * A = 8*10^3$$

$$A = \frac{8*10^3}{30} = 266.67$$

$$\Rightarrow \frac{\pi}{4} D^2 = 266.67$$

$$0.785\, D^2 = 266.67$$

$$\Rightarrow D^2 = 339.53 \Rightarrow D = \sqrt{339.53}$$

$$= 18.426\ mm$$

(2)

Question Two: For the steel plate shown determine:

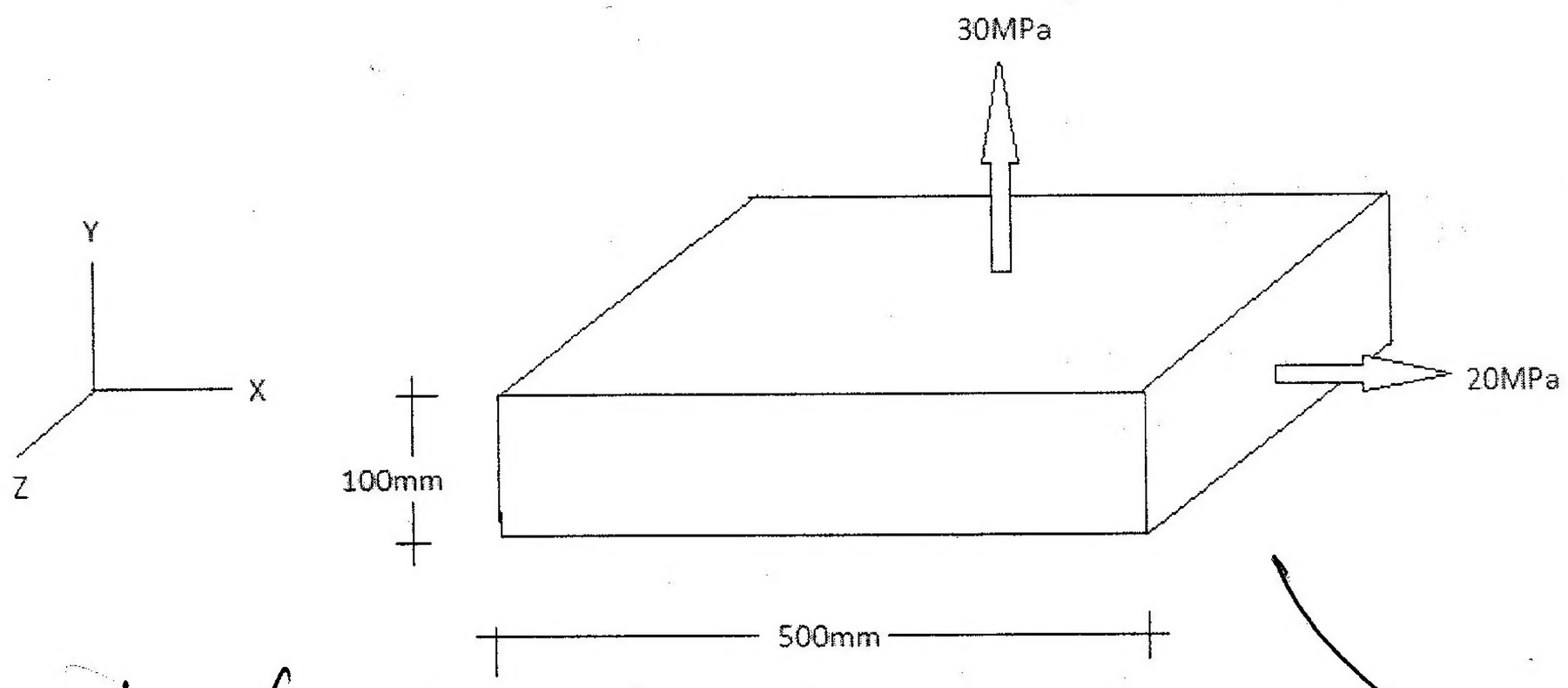
1. The deformation of plate in X direction?
2. The deformation of plate in Y direction?

$G = \frac{E}{2(1+\upsilon)}$

$70*10^3 = \frac{E}{2(1+0.3)}$

$E = 182*10^3$

Assume elastic behavior. Consider the shear modulus G= 70Gpa and the passion's ratio υ=0.3.



$\varepsilon_x = \frac{1}{70*10^3}(20MPa - \upsilon(30MPa + 0))$

$= 1.4286*10^{-5}(20MPa - 0.3(30))$

$= 1.4286*10^{-5}(11) = 1.57146*10^{-4}$

the deformation in x direction =

$1.57146*10^{-4} * 500 = 0.078573$ mm

$\varepsilon_y = \frac{1}{70*10^3}(30 - 0.3(20+0))$

$= 1.4286*10^{-5}(30-6)$

$= 1.4286*10^{-5}*24 = 3.42864*10^{-4}$

the deformation in y direction

$= 3.42864*10^{-4} * 100 = 0.0342864$ mm.

The deformation in direction x

$$\varepsilon_x = \frac{1}{E}(\sigma_x - \upsilon(\sigma_y + \sigma_z))$$

$$= \frac{1}{182*10^3}(20 - 0.3(30+0))$$

$$= 5.4945*10^{-6}(11) = 6.044*10^{-5}$$

The deformation in x direction =

$$6.044*10^{-5} * 500 = 0.03022 \text{ mm.}$$

$$\varepsilon_y = \frac{1}{182*10^3}(80 - 0.3(20+0))$$

$$= 5.4945*10^{-6}(24) = 1.31868*10^{-4}$$

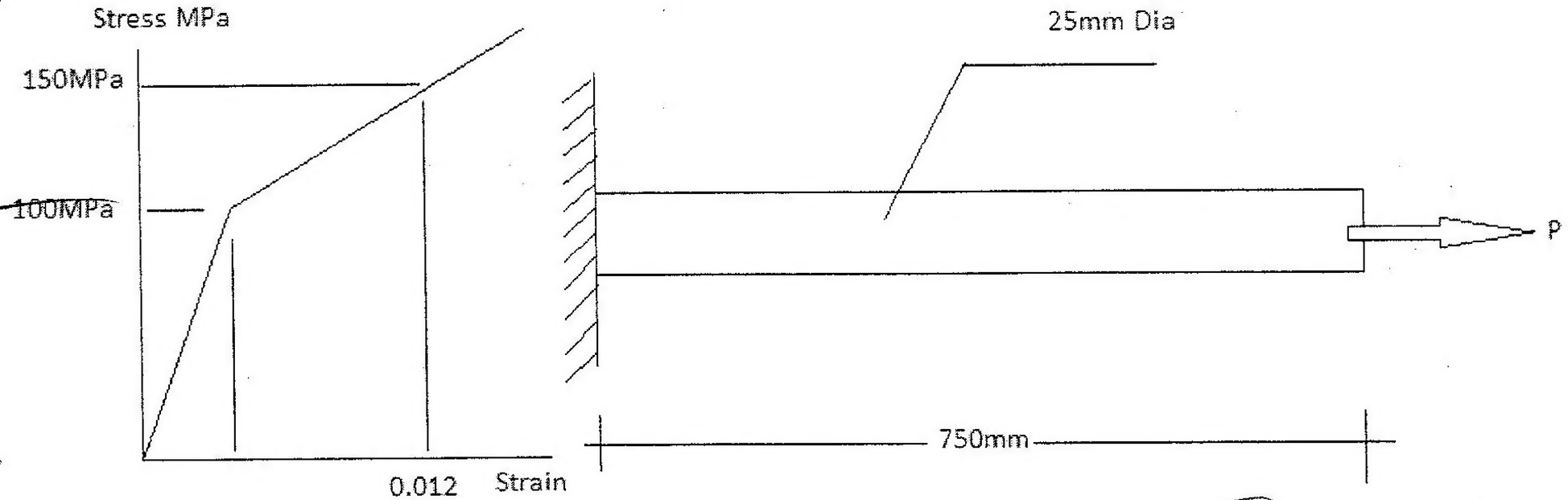
The deformation in y direction

$$= 1.31868*10^{-4} * 100 = 0.0131868 \text{ mm.}$$

Question Three: For the figure shown; determine

1. The deformation of the bar if P =20kN.
2. The deformation of the bar if the load is increased to P =73.63kN.
3. The deformation of the bar when P =73.63kN is removed?

Consider E=70GPa



$12*10^{-3}$

① $\sigma = \frac{20*10^3}{\frac{\pi}{4}(25)^2} = \frac{20000}{490.87} = 40.74\ MPa$. Less than 100MPa

So its behaviour is elastic

1.5 $\sigma = E\varepsilon$

$40.74\ MPa = 70*10^3\ \varepsilon \Rightarrow \varepsilon = \frac{40.74}{70*10^3} = 5.82*10^{-4}$

the deformation in the bar $= 5.82*10^{-4} * 750 = 0.4365\ mm$.

② $\sigma = \frac{73.63}{\frac{\pi}{4}(25)^2}*10^3 = \frac{73.63*10^3}{490.87} = 150\ MPa$. Plastic behaviour.

1.5 $\varepsilon = 0.012 = 12*10^{-3}$

the deformation then $= 12*10^{-3} * 750 = 9\ mm$.

$\Delta L = 9.4365\ mm$.

التكملة خلف الورقة

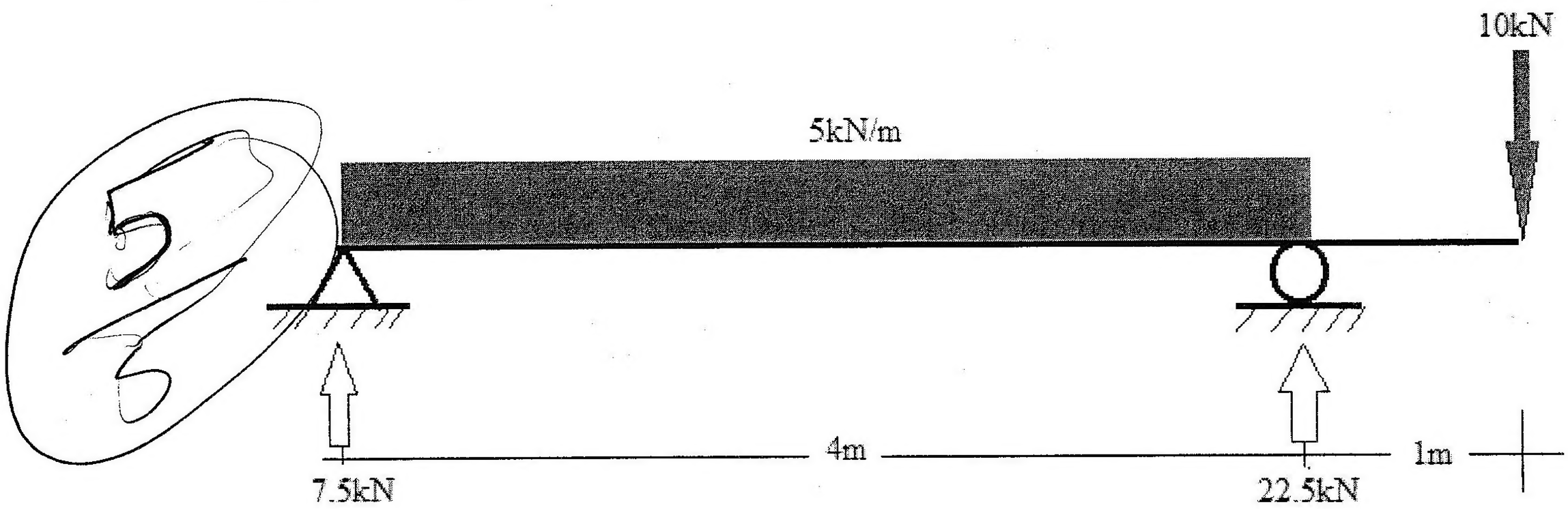
(3) The ~~deformation~~ is moved.

$$E_{recovery} = \frac{150}{70 * 10^3} = 2.1429 * 10^{-3}$$

$$\Delta = (12 * 10^{-3} - 2.1429 * 10^{-3}) * 750 = 7.393 \text{ mm.}$$

when P is moved.

Question Four: Draw the Bending Moment Diagram BMD for the beam shown? The shear force diagram is drown.



S.F.D